

# GAME BIRD RESEARCH PROGRAM

Oregon State University



## HABITAT USE BY SAGE GROUSE ON THE BEATY BUTTE BLM ALLOTMENT FINAL REPORT 2000

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## INTRODUCTION

Sage grouse (*Centrocercus urophasianus*) have decreased in abundance and distribution throughout their range in the Western United States and Canada (Johnsgard 1983). Between 1973 and 1998 sage grouse have declined 80-90% across their range (C.E. Braun, pers. commun.). Sage grouse have been extirpated from Arizona, Kansas, Nebraska, New Mexico, Oklahoma and British Columbia (Connelly and Braun 1998). Current distribution extends from southern Saskatchewan and Alberta south through western North Dakota, South Dakota, Montana, Wyoming, Utah, Colorado, central Washington, Oregon, Nevada and northeastern California (Johnsgard 1983). In Oregon, abundance declined 60% from 1940 to 1980 and they currently inhabit approximately 50% of their original range in the state. Sage grouse have been extirpated from Jefferson, Wasco, Sherman, Gillman, Marrow, and Umatilla Counties, and their range reduced in Klamath, Lake, Deshutes, Crook, Wheeler, Grant, Baker and Union Counties (Crawford and Lutz 1985).

Alteration of sagebrush-steppe habitats has contributed to sage grouse population declines. Degradation of sagebrush habitats has been caused by conversion to agriculture, urban development, habitat fragmentation, sagebrush (*Artemisia sp.*) control programs, introduction of exotic plants and animals, and altered fire regimes (Dalke *et al.* 1963, Johnsgard 1983, Miller 1989). The decline of sage grouse populations closely paralleled the period of maximum use by livestock between 1900 and 1915 (Klebenow 1972). Historic overgrazing has resulted in shrub dominance with an associated reduction of the herbaceous component (Miller and Eddleman 2000).

Although sagebrush obligates, sage grouse reproduction is greatly affected by herbaceous components. In Oregon, Barnett (1994) found that forbs made up 20-50% of the diet of pre-



laying females. Forbs were higher in crude protein, phosphorus, and calcium than sagebrush, and the nutritional status of females affected reproduction. Residual grass cover and specific structural sagebrush characteristics provide for successful nesting (Gregg *et al.* 1994, Sveum *et al.* 1998). The primary cause of nest loss is predation (DeLong *et al.* 1995). Tall dense vegetation provides visual, scent and physical barriers between predators and ground nests (Redmond *et al.* 1982) and, ultimately, the available vegetation affects sage grouse nest success (Gregg *et al.* 1994). In Washington, Sveum (1998) reported a nesting preference for Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), and in Oregon, Coggins (1997) reported a preference for mountain big sagebrush (*A. t. vaseyana*). There were no differences in proportions of successful nests among cover types, so nest success was not related to the 3<sup>rd</sup> order cover type in which females nested. At Hart Mountain National Wildlife Refuge, mean habitat characteristics at nest sites (1m radius of the nest) included 12-15% tall grass ( $\geq 18\text{cm}$ ) cover and 31-34% medium sage (40-80cm) cover (Coggins 1997). Successful sage grouse nests had greater residual tall grass and medium height sagebrush cover than depredated nests or random plots. Successful nests had mean tall grass cover of 18% and medium shrub cover of 41%. Tall grass and medium shrubs provide the needed horizontal and canopy cover for nesting sage grouse (Gregg *et al.* 1994). Similar trends were noted in Washington (Sveum 1998). This conclusion was further substantiated by experiments with artificial nest experiments (DeLong *et al.* 1995). Grass cover, generally was considered related to success in Utah (Rasmussen & Griner 1938), Idaho (Autenrieth 1981, Wakkinen 1990), and Montana (Pyrah, 1970).

Sage grouse broods in southeastern Oregon typically move into low sagebrush areas during the early brood rearing period (0-6 weeks) and move into big sagebrush areas during the late brood rearing period (7-12 weeks). Brood-use areas have greater forb frequencies than



randomly available; forb availability influenced use of cover types, movements and diet. Early brood-use areas had total forb cover between 10-14% and late brood rearing areas 19-27% (Drut 1994). In south central Washington, Sveum (1998) reported total forb cover was 23% and 24% during early and late brood rearing periods, key forb cover was 6% and greater than at random locations.

Sage grouse have been listed as a "sensitive species" in portions of north-central Oregon by the Oregon Department of Fish and Wildlife. Petitions for federal listing under the Endangered Species Act have been submitted for Washington, and portions of Colorado, and Utah. Other petitions are being prepared for the remainder of their range.

Field studies on sage grouse were conducted in 2000 by the Game Bird Research Program at four study areas in southeastern Oregon and northwestern Nevada: Hart Mountain National Antelope Refuge, Sheldon National Wildlife Refuge, South Steens BLM Allotment, and Beatys Butte BLM Allotment. The objectives of these studies were to determine sage grouse productivity and to better understand habitat use and the effects of prescribed fire in big sagebrush ecosystems.

## **ACKNOWLEDGEMENTS:**

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## GOALS

To better understand the habitat use, distribution, population attributes, and productivity of sage grouse on Beatys Butte BLM Allotment, Oregon.

## OBJECTIVES

- 1) Locate and monitor leks and male sage grouse.
- 2) Radio-tag female sage grouse to determine reproductive success.
- 3) Determine habitat use by sage grouse during the breeding season.
- 4) Determine home ranges and movements.

## STUDY AREA

The Beatys Butte BLM Allotment is an area consisting of 220,301 ha (2,203 km<sup>2</sup>), including 205,174 ha of public land and 15,127 ha of private land in Lake and Harney Counties in southeastern Oregon adjacent to the Nevada border. The Lakeview District of the Bureau of Land Management administers the allotment. Beatys Butte Allotment is east and southeast of Hart Mountain National Antelope Refuge and north of Sheldon National Wildlife Refuge (Figure 1). The study area included all of South Pasture and the southern one-half of North Pasture. Both pastures are approximately 84,000 ha. The area of North Pasture is higher in elevation than the surrounding areas and characterized by a mosaic of mesic mountain big sagebrush (MBS), low sagebrush (*A. arbuscula*) and a prescribed burn.



The topography is characterized by rolling expanses of Wyoming big sagebrush (WBS) and low sagebrush canyons, rim rock tables dominated by low sagebrush and areas with a mosaic of low sagebrush (LSB) and mountain big sagebrush (MBS) (Table 1). There were two recent fires on the allotment: a 1999 fall prescribed burn of approximately 6,000 ha, and the Beatys Butte wildfire of 14,400 ha in July 2000 (J. Pollet, pers. commun.). Elevation ranges from 1500 m to 2400 m. Mean annual precipitation is 23 cm and the annual average maximum temperature is 18 C and the minimum is 1 C (Western Regional Climate Center).

The Beatys Butte Allotment had a permitted grazing capacity of 26,121 AUMs from 1983 to 1989. Since 1989, the permitted grazing capacity has been 14,000 AUMs. South Pasture has a total capacity of 19,000 AUM (~ 4,000 cows). Approximately 1,400 cows were on South Pasture between 1 April and 1 August 2000. South Pasture was previously grazed in 1998 and rested in 1999. North Pasture also has a total capacity of 19,000 AUMs and was grazed in 1999. Because of the prescribed burn in the fall 1999, it will not be grazed again the end of 2002 or later (L. Booth, pers. commun.).

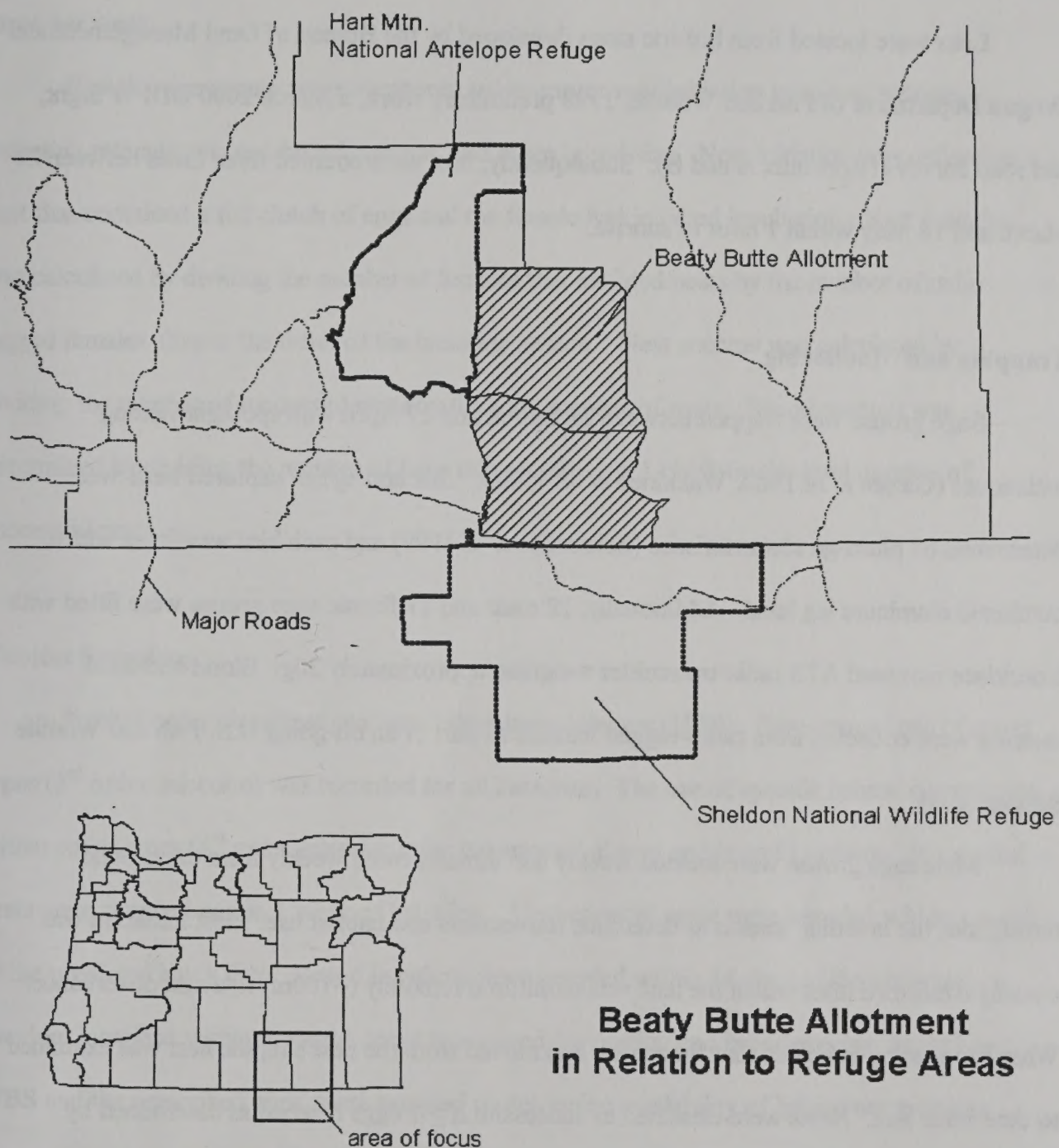


Table 1. Description of cover types on Beatys Butte Allotment (adapted from Gregg 1992), Harney County, Oregon, 2000.

Cover Type	Cover Type Description
Low sagebrush (LSB)	Found on alluvial fans, table lands with <30% slope, exposed ridges, and side slopes. Primary plant species include low sagebrush ( <i>Artemisia arbuscula</i> ), rabbit brush ( <i>Crysothamnus sp.</i> ), bluebunch wheatgrass ( <i>Pseudoroegneria spicata</i> ), bluegrass ( <i>Poa sp.</i> ), and Idaho fescue ( <i>Festuca idahoensis</i> ). May also be associated with spiny hopsage ( <i>Atriplex spinosa</i> )
Mountain big sagebrush (MBS)	Occurs at higher elevations (1800 to 2300m) on mountainsides and ridges. Primary plant species are mountain big sagebrush ( <i>A. tridentata. vaseyana</i> ) and Idaho fescue or rough fescue ( <i>F. scabrella</i> ).
Wyoming big sagebrush (WBS)	Occurs on rolling uplands. Primary plant species include Wyoming big sagebrush ( <i>A. t. wyomingensis</i> ), rabbit brush, horsebrush ( <i>Tetradymia sp.</i> ), bottlebrush squirreltail ( <i>Elymus elymoides</i> ), and Thurber's needlegrass ( <i>Stipa thurberiana</i> ). May also be associated with spiny hopsage.
Basin big sagebrush (BBS)	Occurs on low terraces associated with drainages and lake basins. Primary plant species include basin big sagebrush ( <i>A. t. tridentata</i> ) and giant wild rye ( <i>Leymus balticus</i> ).
Mixed sagebrush (MSC)	Associated with scab rock areas, ridge tops, sloping tablelands, and alluvial plains, where cover types meet. Primary plant species include low sagebrush, big sagebrush, and needlegrass.
Mountain shrub (MTS)	Occurs at elevations between 1800 and 2300 m. Primary plant species are mountain big sagebrush, antelope bitterbrush ( <i>Purshia tridentata</i> ) and Idaho fescue. May also be associated with western snowberry ( <i>Symphoricarpos occidentalis</i> )
Juniper/Aspen/Mahogany (JAM)	Associated with low ridges or foot slopes. Primary plant species are western juniper ( <i>Juniperus occidentalis</i> ), mountain mahogany ( <i>Cercocarpus lepifolius</i> ), or aspen ( <i>Populus tremuloides</i> ). Maybe interspersed with big or low sagebrush.
Lakebed/Playa (LAK)	Found on depressions covered with water during spring. Primary plant species include silver sagebrush ( <i>A. cana</i> ), spikerush ( <i>Eleocharis sp.</i> ), and Baltic rush ( <i>Juncus balticus</i> ).
Meadow (MEA)	Associated with springs and creeks that have poorly drained soils and summer subsurface water. Primary plant species include bluegrass, wheatgrass, and sedge ( <i>Carex sp.</i> )
Grassland (GRA)	Typically areas disturbed by fire. Areas without sagebrush. Primary plant species include cheat grass ( <i>Bromus tectorum</i> ), giant wild rye, bottlebrush squirreltail, bluegrass, and needlegrass.



Figure 1. Location of the Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.



## MATERIALS AND METHODS

### Lek Monitoring

Leks were located from historic maps developed by the Bureau of Land Management and Oregon Department of Fish and Wildlife, 1998 preliminary work, a March 2000 ODFW flight, and road surveys (Appendix A and B). Subsequently, leks were counted three times between 21 March and 18 May within 1 hour of sunrise.

### Trapping and Monitoring

Sage grouse were trapped between 21 March and 27 April with spotlight-netting techniques (Giesen *et al.* 1982, Wakkinen *et al.* 1992). Sex and age of captured birds were determined by plumage characteristics (Schroeder *et al.* 1999) and each bird was fitted with a numbered aluminum leg band. Additionally, 12 male and 17 female sage grouse were fitted with a necklace mounted ATS radio transmitter weighing approximately 20g. Blood and fecal samples were collected from radio-tagged females as part of an on-going U.S. Fish and Wildlife Service study.

Male sage grouse were located weekly and females twice weekly from the ground throughout the breeding season to determine movements and habitat use. Nest initiation was visually confirmed after which the nest was monitored remotely (~100m) to avoid disturbance. When monitoring indicated that the female had moved from the nest site, the nest was examined to determine fate. Nests were classified as successful if  $\geq 1$  eggs hatched as determined by detachment of the eggshell membrane. Clutch size was based on enumeration of completed clutches from egg counts at nests after a female was flushed during incubation, post predation or after hatching. Females with successful nests were monitored to determine habitat use and



brood success. Broods were considered successful if  $\geq 1$  chick was recruited into the population by 1 August. Broods were monitored daily until 30 days old; thereafter, they were monitored 3 times per week.

Female sage grouse were monitored to determine nest initiation rate, nest success, renesting rate and success, brood success, and mean brood size. Nest initiation was defined as a nest that contained a full clutch of eggs and the female had initiated incubation. Nest initiation was calculated by dividing the number of females that initiated nests by the number of radio-tagged females alive at the onset of the breeding season. Nest success was calculated by dividing the number of successful nests by the total number of nests. Brood success was determined by dividing the number of hens that recruited  $\geq 1$  chick by the total number of successful nests.

### **Habitat Sampling**

Habitat order classifications were taken from Johnson (1980). Sage grouse use of cover types (3<sup>rd</sup> order selection) was recorded for all locations. The use of specific habitat components within cover types (4<sup>th</sup> order selection) was determined at nest and brood locations. Successful nests were sampled within 1 week of hatching. Unsuccessful nests were sampled within 1 week of the predicted hatch date. Brood locations were sampled within 14 days of the observation. Random locations within the same cover types used for nesting and brood-rearing, as well as WBS and the prescribed burn, were sampled to determine availability of habitat components. Random locations were sampled during the nesting and brood rearing seasons, May and late June-early July, respectively.

Random locations and transect bearings were determined from a random numbers table. Previous grazing practices were not a consideration in selection of random plots. However, cover type distribution influenced the number of plots in grazed and ungrazed areas. Most of the MBS habitat was in North Pasture, which was ungrazed in 2000 whereas most of the LSB and WBS habitat was in South Pasture, which was grazed.

Shrub canopy cover was measured at nest, brood, and random locations with the line intercept method (Canfield 1941) along 2 10-meter perpendicular transects centered at the nest, brood, or random location. Shrub canopy cover was classified into 1 of 3 categories: short (<40 cm), medium (40-80 cm), and tall (>80 cm). Shrub cover was recorded separately for each species and height class. Forb and grass cover, frequency, and species composition were measured in 10 20-x-50 cm plots placed equidistantly along the transects (Daubenmire 1959). Forbs were classified as key or non-key forbs. Cover and frequency were recorded for 14 key-forb species, genera, or groups: yarrow (*Achillea millefolium*), dandelion (*Agoseris* sp., *Microseris* sp., *Taraxacum* sp.), everlasting (*Antennaria* sp.), aster (*Aster* sp.), locoweed (*Astragalus* sp.), belpharipappus (*Belpharipappus* sp.), hawksbeard (*Crepis* sp.), daisy (*Erigeron* sp.), buckwheat (*Eriogonum* sp.), monkey flower (*Mimulus* sp.), broomrape (*Orobanche* sp.), micosteris (*Phlox gracilis*), long-leaved phlox (*P. longifolia*), sagebrush buttercup (*Ranunculus glaberrimus*), yellow salsify (*Tragopogon dubius*), and clover (*Trifolium* sp.). The tallest droop height of grasses, excluding flower stalks and non-key forbs were classified into 1 of 2 categories: short (<20 cm) and tall ( $\geq$  20 cm). Sagebrush was identified to subspecies; all other habitat components were identified to genus or species.



## DATA ANALYSIS

### Movement and Home Range

Distance was determined by calculating the straight-line distance between capture sites and nest sites or capture sites and final location. Home range was calculated with the 100% Minimum Convex Polygon (MCP) (Mohr 1947) and CALHOME (California Home Range) program.

Home range was divided into spring and summer home range. Spring home ranges were calculated from capture date until approximately 1 June. For brooded females the summer period started on the hatch date. For broodless females it started on 1 June or the first location post-nest failure, whichever date was later. For non-nesting females and ones of unknown reproductive status summer started on 1 June. The summer monitoring period ended 1 August for all females.

### Vegetation comparison

Vegetative components of nest and brood plots, a 5-meter radius area ( $78\text{m}^2$ ), were compared with random plots within the same cover types. Random plots from spring and summer, in different cover types were compared to each other. Nest sites, the 1-meter radius area ( $3\text{m}^2$ ) centered at the nest, were compared between MBS and LSB nest sites. For analysis, sagebrush was divided into separate categories by height class. Snowberry and rabbitbrush were analyzed individually. All other shrubs were combined and analyzed collectively: cherry (*Prunus sp.*), current (*Ribes sp.*), horsebrush (*Tetradymia sp.*), rose (*Rosa sp.*), and serviceberry (*Amelanchier alnifolia*). Grazed and ungrazed plots were not compared because of small, unequal sample sizes and incomplete data. A Student's T-test (type 1, 2-tailed) was used to compare percent cover between nest and brood locations with random plots within the same



cover type. Shrub, key forbs, non-key forbs, and grass cover was analyzed for differences with a one-way ANOVA ( $P \leq 0.05$ ) between random plots in different cover types. When significant differences were detected a Fisher's LSD Multiple Comparison test was used to determine which specific variables differed.

## RESULTS AND DISCUSSION

### MALE SAGE GROUSE

Six sage grouse leks were counted 3 times between 21 March and 18 May on South Pasture (Figure 2). Maximum lek counts were: Aspen-14, Juniper-16, Last Chance-65, Paradise Complex-45, Potholes-29, and Snip-17 male sage grouse. Thirty-seven males were captured and banded (Appendix C); 12 males were fitted with radio transmitters (Table 2).

Table 2. Sage grouse males captured and radio marked by lek, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Lek	Captured	Radio-Tagged
Aspen	6	3
Corral	1	0
Juniper	2	1
Last Chance	5	4
Paradise	13	4
Potholes	10	0
Snip	0	0

Radio-tagged males were relocated twice monthly during the nesting period and once a week during the brood-rearing period (Appendix E). One male slipped his radio immediately after capture, 1 male slipped his radio 3 weeks post-capture and was later harvested, 3 were depredated near leks, 3 were depredated during the post lek period. The mortality rate of males from March until August was 55% (6/11). All deaths were attributed to mammalian predators. Radio-tagged males left display areas by the first week of June. Males moved in two general directions, southwest and north. Three moved in a southwesterly direction: 2 to near Snake



Eyes Spring and 1 on to Sheldon National Wildlife Refuge. Four moved in a northerly direction to the area between Buckaroo Pass and Mudhole Spring, where 3 were depredated. At the time of radio loss (21 May), another male had been moving erratically north and west away from the lek. The mean southwesterly distance moved was 19.2 km (range 17.0 - 21.5 km) and mean northerly movement was 7.1 km (range 4.89 - 8.96 km). All males that moved north to higher elevation were originally captured at Aspen or Paradise leks. Mean home range of males known to have survived until 1 June (7 of 12) was 33.9 ha (range 5.3 - 112.4 ha) (Table 3).

Table 3. Seasonal movement and home range, March-July, of male sage grouse on Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Band #	Capture Lek	Fate	Distance <sup>c</sup> (km)	Direction	N <sup>a</sup>	Range (ha)
2508	Aspen	Live	17.0	Southwest	12	38.7
2509	Aspen	Live	9.0	North	12	16.0
2302	Last Chance	Live	18.9	Southwest	9	112.4
2525	Last Chance	Live	21.5	Southwest	5	72.9
2320	Aspen	LR <sup>b</sup>	0.3	Lek	2	-
2301	Juniper	Dep.	1.3	Lek	2	-
2306	Last Chance	Dep.	0.4	Lek	5	0.1
2307	Last Chance	Dep.	4.9	North	4	5.6
2316	Paradise	Dep.	0.6	Lek	2	-
2319	Paradise	Dep.	6.2	North	5	8.4
2503	Paradise	Dep.	8.0	North	7	12.2
2528	Paradise	Dep.	7.6	North	7	5.3

<sup>a</sup> N= number of relocations.

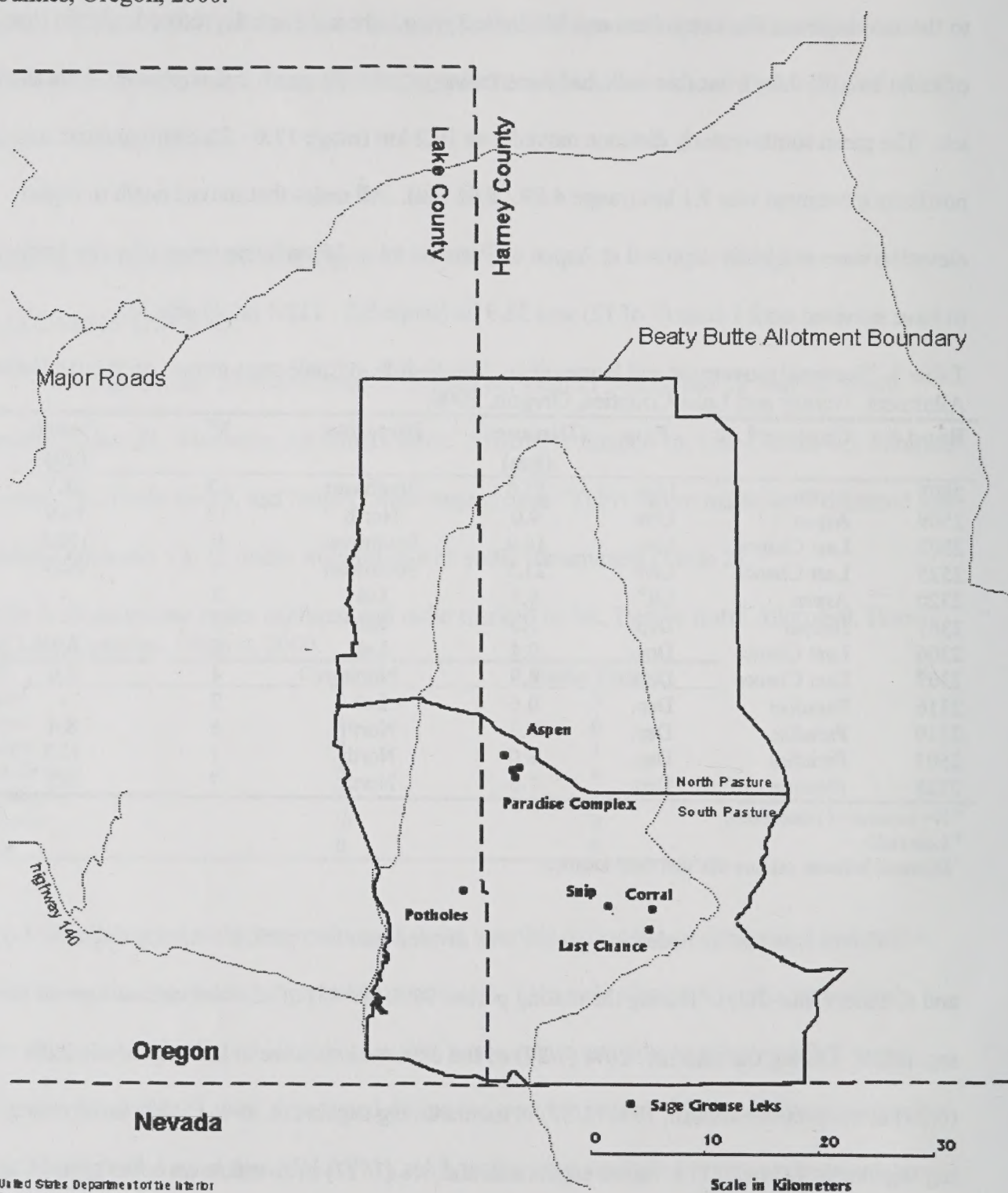
<sup>b</sup> Lost radio

<sup>c</sup> Distance between capture site and final location.

Cover type use by male sage grouse was divided into two periods: mating (March-May) and summer (June-July). During the mating period 96% (43/45) of all observations were in low sagebrush. During the summer, 26% (7/27) of the observations were in low sagebrush, 22% (6/27) in the prescribed burn, 19% (5/27) in mountain big sagebrush, 19% (5/27) in Wyoming big sagebrush, 11% (3/27) in mixed sagebrush, and 4% (1/27) in an unknown cover type. The reduced number of locations as the season progressed resulted from a smaller sample size caused by depredation and radio loss.



Figure 2. Locations of leks used in this study, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.



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## FEMALE SAGE GROUSE

Twenty-three female sage grouse were captured (Appendix D). All females were banded and 17 were radio-tagged (Table 4). Blood samples were taken from 13 radio-tagged females, and 11 fecal samples were collected. One female was captured on 24 April with a brood patch.

Table 4. Sage grouse females captured and radio marked by lek, Beatys Butte Allotment, Harney and Lake Counties, Oregon 2000.

Lek	Captured	Radio Marked
Aspen	4	3
Hawks Valley <sup>a</sup>	2	0
Juniper	2	2
Last Chance	1	1
Paradise	7	5
Potholes	3	2
Snip	4	4

<sup>a</sup> Near a road, no known lek in vicinity.

## Nesting

Twelve radio-tagged female sage grouse initiated nests, 1 female did not. We were unable to determine nest initiation for 4 hens and they were not included in the calculations of nest initiation or nest success. Average distance between capture leks and nest locations was 3.0km (0.2 to 9.0 km). In Wyoming, birds were reported nesting < 2.5 km or > 5 km away from leks (Berry and Eng 1985). In our study nesting females moved  $\leq 2$  km or  $> 4$  km. All 4 female grouse that moved  $> 4$  km were captured at Aspen and Paradise leks and moved onto North Pasture. Three females from Aspen and Paradise leks moved < 2.5 km to nest. After failed nesting attempts, females moved an average of 4.2 km (range 0.3 - 28.8km) (Table 5).



Table 5. Distances moved by radio-tagged females from capture site to nest location, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Band #	Age	Lek to Nest (km)	Nest Fate	Moved Post Failure (km) <sup>a</sup>
1701	YR	8.0	Depredated	1.3
1702	YR	1.0	Hatched	-
1706	YR	0.3 (2.4 <sup>b</sup> , 2.1 <sup>c</sup> )	Depredated, Abandoned	1.6, 3.5
1707	AD	0.6	Depredated	1.0
1708	YR	1.0 (3.9 <sup>b</sup> , 3.0 <sup>c</sup> )	Depredated, Depredated	0.5, 0.9
1709	YR	4.8	Depredated	1.1
1711	YR	1.2	Depredated	-
1712	AD	2.0	Depredated	4.9
1718	YR	0.2	Depredated	3.1
1724	YR	1.2	Abandoned	3.3
1728	YR	9.0	Depredated	28.8
NA	AD	7.8	Abandoned	0.3

<sup>a</sup> distance between nest and first location post-failure

<sup>b</sup> distance from initial nest to reneest

<sup>c</sup> distance between lek and reneest

The nest initiation rate was 92% with 12 of 13 females initiating nests. Eight percent (1/12) nests were successful. Nest success in Oregon typically ranges from 15-41% (Gregg 1992, T.H. Bliss pers. commun) and from 15-77% through their range (Schroeder *et al* 1999). Nine of the initial nests were depredated, 2 were abandoned, and 1 was successful. Two of 10 (20%) females attempted to reneest. None of the reneesting attempts were successful; 1 nest was depredated and 1 was abandoned. The average initial clutch size was 7.0 eggs (range 6.0-8.0). The mean nest initiation date was 29 April (range 17 April-20 May). For the 16 radio-tagged females alive on the mean nest initiation date, 1 female recruited 3 chicks into the 1 August population (Table 6). The recruitment rate was 19% or 19 chicks/100 hens. Recruitment necessary for a sustainable population is considered 100 chicks/100 hens (C.E. Braun, pers. commun.). Four of 17 (24%) females were depredated between March-August: 1 on the nest, 2 post-nesting, and 1 at an unknown stage early in the spring. One additional radio-tagged female



was found, dead next to a fence, north of Spaulding Reservoir during the sage grouse hunting season.

### Comparison among study sites

A summary of sage grouse productivity from Beatys Butte Allotment, Hart Mountain National Wildlife Refuge, Sheldon National Wildlife Refuge, and South Steens Allotment are provided in Table 6 as an overview of the 2000 field season in southeastern Oregon and northeastern Nevada. Nest initiation, renesting rate, and renesting success rates from Beatys Butte were comparable to those from the other study sites. However, nest success and subsequent number of chicks recruited was significantly lower. Lack of residual tall grass cover, <4.5% mean cover at nest and random plots, and the propensity of the Beatys Butte females we captured, to nest in low sagebrush may account for the relatively high rate of nest predation, 71% (10 of 14 nests).

Table 6. Reproductive success of radio-tagged sage grouse at 4 study areas 2000.

Study Site	Beatys Butte	Hart Mountain	Sheldon	South Steens
Total Marked	17	19	41 <sup>a</sup>	17
Category	% (N)	% (N)	% (N)	% (N)
Nest Initiation	92(12/13)	100 (15/15)	94 (30/32)	92 (11/12)
Renesting Rate	20(2/10)	20 (1/5)	11 (2/18)	25 (1/4)
Nesting Success	8(1/12)	56 (9/16)	37 (11/30)	64 (7/11)
Renest Success	0 (0/2)	0(0/5)	100 (2/2)	0 (0/4)
Initial Mean Clutch	7.0	7.0	7.0 <sup>b</sup>	6.5
Renest Mean Clutch	5.5	7.0	7.0	4.0
Chicks Recruited	3	21	21	13
Chicks/Brood	3.0	2.3	2.6	2.2

<sup>a</sup> Includes birds radio marked in 1999.

<sup>b</sup> Includes successful clutches only.

### Movement

Through the field season, females moved in 3 general directions: north, southwest, and east. Five moved north to higher elevation and 4 nested in this area. They remained between Buckaroo Pass and Dropoff Waterhole for the summer; one female moved 28.8 km south after



her nest was depredated, before returning a month later. Five moved in a southwesterly direction. During the spring, 1 female moved 15.9 km south from Potholes lek to 1.5 km north of the Sheldon NWR border before being depredated. During the summer, 2 females moved onto Sheldon National Wildlife Refuge, 1 moved near Snake Eyes Spring and was observed in a mixed flock including radio-tagged males, and 1 moved to the Sage Hen Creek area. Three moved east: 2 onto Acty Mountain, and 1 into Hawksy Walksy. Unsuccessful females (14 of 17) that survived beyond 1 June moved an average of 13.8 km (range 3.0 - 41.6 km) from their place of capture to their last known location. Mean southwesterly movement was 26.9 km (range 16.8 - 41.6), northerly was 9.6 km (range 6.7 - 19.7 km), and easterly was 6.9 km (range 3.0 - 12.1).

Table 7. Straight line distance from place of capture to final location of female sage grouse on Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Band #	Capture Lek	Fate	Distance: capture site to last location (km)	General Direction of movement
1709	Aspen	Live	6.7	North
1710	Aspen	Live	31.4	Southwest
1705	Juniper	Live	19.7	North
1718	Juniper	Live	41.6	Southwest
1712	Last Chance	Live	5.5	East
1701	Paradise	Live	7.8	North
1702	Paradise	Live	0.4	-
1724	Paradise	Live	11.2	North
1728	Paradise	Live	12.6	North
1703	Potholes	Live	6.7	Missing
1707	Snip	Live	16.8	Southwest
1708	Snip	Live	17.7	Southwest
2321	Snip	Live	12.1	East
1711	Aspen	Dep.	1.2	-
NA	Paradise	Dep.	9.4	North
1704	Potholes	Dep.	15.9	Southwest
1706	Snip	Dep.	3.0	East

## Home range

Home ranges of female sage grouse were highly variable. During the spring the brooded female had the smallest home range consisting of her capture site and the nest area. Broodless females had a mean home range of 4.4ha (range 0.7 - 12.4 ha). Home range size was affected by the distance between lek and nest, nest initiation date, length of time the nest was active, and date of failure. Non-nesting females and females of unknown reproductive status collectively had the largest mean home range 37.0 ha (range 3.5 - 82.4 ha). During the summer/brood rearing period, the brooded hen continued to have a limited home range (2.0 ha). Broodless females had a mean summer range of 19.2 ha (range 1.0 - 98.7 ha) and non-nesters/unknown had a home range of 20.6 ha (range 1.5 - 50.1 ha). Females in MBS areas during the spring tended to remain in that cover type. Other females tended to move toward more mesic areas of MBS or to springs and waterholes. Through the field season the brooded hen remained on the northeastern corner of Aspen Table on an area of 2.3 ha. All other females that survived beyond 1 June had a mean total home range of 58.1 ha (range 6.1-183.1 ha). Females 1710 and 1718 had the largest overall ranges and distances between capture site and final location, caused by their moving onto Sheldon National Wildlife Refuge. Female 1728 also had a large home range caused by her move from North Pasture to Sage Hen Butte and back.



Table 8. Home ranges of female sage grouse on Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Band #	N <sup>a</sup>	Spring (ha)	N <sup>a</sup>	Summer (ha)	N <sup>a</sup>	Total Season (ha)
<b>Brooded</b>						
1702	6	-	46	2.0	52	2.3
<b>Broodless</b>						
1701	13	7.9	9	1.0	22	12.6
1706	9	4.9	5	1.3	14	6.1
1707	7	1.3	8	29.3	15	51.9
1708	12	4.7	7	14.0	19	29.7
1709	10	0.7	9	6.8	19	13.3
1711	6	1.9	-	-	-	-
1712	10	12.4	8	9.2	18	19.7
1718	10	1.9	4	98.7	14	183.1
1721	9	4.1	12	13.2	21	23.5
1728	11	3.7	3	38.2	14	110.2
NA	7	4.8	-	-	-	-
<b>Non-Nester</b>						
2321	7	28.2	7	14.7	14	28.2
<b>Unknown</b>						
1703	9	13.0	3	1.5	12	-
1704	3	82.4	-	-	-	-
1705	10	21.0	10	16.0	20	84.0
1710	0	3.5	7	50.1	15	134.3

<sup>a</sup> Number of relocation

### Habitat use

Use of cover types was divided into spring and summer. The primary cover types used during the spring were LSB 64% (95/149) and MBS 29% (43/149). All other cover types used (WBS, BBS, MSC, prescribed burn, and unknown) totaled 7% (11 of 149 relocations).

Excluding the brooded female, the primary cover types used during summer were MBS 48% (44/92) and LSB 29% (27/92). Other cover types used included MSC 9% (9/92), WBS 8% (7/92), LAK 3% (3/92) and prescribed burn 3% (3/92).

## HABITAT ANALYSIS

### Nest

Females nested in 2 cover types; 8 (57%) in low sagebrush, and 6 (43%) in mountain sagebrush. The only successful nest was in low sagebrush. Habitat sampling of 14 nests was completed between 20 May and 11 June. Random sampling of locations in the same cover types, and Wyoming big sagebrush was completed between 4 May and 20 May. Thirteen of 14 (93%) nests were located under sagebrush, 1 was located under serviceberry.

In LBS, nest plots had more low sagebrush ( $P=0.04$ ) and less short grass cover ( $P<0.01$ ) than random plots. In MBS, there were no differences between nest and random plots. Shrub cover at nest plots was 30.2% ( $SE=1.8$ ) in LSB and 40.5% ( $SE=2.2$ ) in MBS (Table 9, Appendix G).

In a comparison of LSB and MBS nest sites, MBS sites had more medium sagebrush than LSB sites ( $P<0.01$ ). At other study areas, nests typically were located under medium height shrubs regardless of cover type (Gregg 1992). Only two nests in LSB were under medium height sagebrush, suggesting a lack of optimum height low sagebrush. The majority of females nested in LSB reflected the limited availability of MBS on Beatys Butte Allotment. Tall grass cover, mean  $<1.5\%$  at nest sites in both cover types was far short of the 12-14% found at typical nest sites and the 18% found at successful nest sites (Coggins 1997, Gregg 1994). The limited tall grass component consequently resulted in high predation of nest consistent with inadequate cover.



Table 9. Mean percent cover at nest and random plots, Beatys Butte Allotment, Harney County, Oregon 2000.

Categories	LSB Nest		LSB Random		MBS Nest		MBS Random	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Key forbs	3.6	0.6	5.8	1.2	3.2	1.5	2.6	0.6
Non-key Forbs	4.7	1.0	5.4	1.2	8.1	2.2	7.6	1.3
Short grass	8.1 <sup>a</sup>	1.6	13.0 <sup>a</sup>	1.5	17.4	4.7	19.5	2.9
Tall grass	1.3	0.8	0.0	0.0	0.7	0.7	0.7	0.6
<b>Shrubs</b>								
Low Sagebrush	26.4 <sup>a</sup>	2.6	16.7 <sup>a</sup>	1.6	12.6	2.1	8.0	1.9
Medium Sagebrush	2.9	2.1	0.0	0.0	17.8	1.8	12.1	1.3
Tall Sagebrush	0.5	0.5	0.0	0.0	2.3	1.2	4.3	2.2
Snowberry	0.0	0.0	0.0	0.0	3.2	3.2	4.0	2.5
Rabbitbrush	1.6	0.3	1.9	0.8	3.1	1.1	2.6	0.8
Other shrubs	0.0	0.0	0.1	0.1	1.4	0.1	1.0	0.4

<sup>a</sup> Means followed by a letter within a cover type are different ( $P < 0.05$ ).

## Brood

Vegetation sampling at 42 brood locations was completed between 29 June and 15 July. Third order data was collected at 46 brood locations. The brood utilized low sagebrush 59% (27/46) and mountain big sagebrush 41% (19/46) of the time. During the early brood rearing period (0-6 weeks), 72% (26/36) of the locations were in low sagebrush. In the late brood rearing period (7-12 weeks), 90% (9/10) of the locations were in mountain big sagebrush. Random sampling of locations in the same cover types, Wyoming big sagebrush and the 1999 prescribed burn was completed 21-29 June.

In LSB, brood locations had significantly more non-key forbs ( $P=0.02$ ), less low sagebrush ( $P < 0.01$ ), and less rabbitbrush ( $P < 0.01$ ) cover than random plots. In MBS, brood locations had more snowberry ( $P < 0.01$ ), less low sagebrush ( $P = 0.03$ ) and less rabbitbrush ( $P < 0.04$ ) than randomly available (Table 10, Appendix G). These differences possibly can be explained by the small area, in which the brood remained. This area was moister than common on South Pasture, indicated by the improved spring, aspen stands, orientation, and presence of snowberry. Shrub cover at brood locations was 14.1% (SE = 1.7) in LSB and 35.86% (SE = 3.3) in MBS.



Table 10. Mean percent cover at brood sites and random locations, Beatys Butte Allotment, Harney County, Oregon 2000.

Categories	LSB Brood		LSB Random		MBS Brood		MBS Random	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Key forbs	4.6	0.6	4.3	0.8	4.6	0.8	3.6	1.1
Non-key Forbs	9.6 <sup>a</sup>	1.5	3.0 <sup>a</sup>	0.7	8.24	1.0	9.7	1.4
Short grass	13.8	1.0	14.0	0.6	11.1	1.2	27.3	4.9
Tall grass	1.3	0.4	1.4	1.0	4.2	1.9	2.7	1.0
<b>Shrubs</b>								
Low sagebrush	13.0 <sup>a</sup>	1.5	23.9 <sup>a</sup>	2.5	3.2 <sup>b</sup>	0.8	6.0 <sup>b</sup>	0.9
Medium sagebrush	0.4	0.3	0.2	0.2	17.7	2.6	13.0	1.4
Tall sagebrush	0.0	0.0	0.0	0.0	1.6	0.7	4.1	2.0
Snowberry	0.1	0.1	0.0	0.0	9.0 <sup>b</sup>	1.9	0.8 <sup>b</sup>	0.7
Rabbitbrush	0.5 <sup>a</sup>	0.2	2.6 <sup>a</sup>	0.8	3.1 <sup>b</sup>	0.7	7.4 <sup>b</sup>	2.1
Other shrubs	0.1	0.1	0.0	0.0	1.3	0.7	1.1	0.6

<sup>a, b</sup> Means followed by a letter within a cover type are different ( $P < 0.05$ ).

### Comparisons of Cover Types

During the spring, three cover types LSB, MBS and WBS were randomly sampled. In a comparison of spring random plots among cover types, LSB plots had no medium height sagebrush. MBS plots had more short grass and other shrub cover than LBS or WBS plots (Table 11, Appendix H). Shrub cover was 18.9% (SE =1.3) in LBS, 32.0% (SE =1.8) in MBS and 26.9% (SE =2.6) in WBS.

Table 11. Spring random plots means and standard error, Beatys Butte Allotment, Harney and Lake Counties, Oregon 2000.

Categories	LSB		MBS		WBS	
	Mean	SE	Mean	SE	Mean	SE
Key forbs	5.8	1.2	2.6	0.6	4.2	0.6
Non-key Forbs	5.4	1.2	7.6	1.3	4.8	0.7
Short grass	13.0	1.5	19.5 <sup>a</sup>	2.9	14.6	2.3
Tall grass	0.0	0.0	0.7	0.6	0.6	0.6
<b>Shrubs</b>						
Low sagebrush	16.7 <sup>a</sup>	1.6	8.0	3.4	5.7	0.8
Medium sagebrush	0.0 <sup>a</sup>	0.0	12.1	1.9	14.9	4.5
Tall sagebrush	0.0	0.0	4.3	2.2	4.0	1.9
Snowberry	0.0	0.0	4.0	2.5	0.0	0.0
Rabbitbrush	1.9	0.8	2.6	0.8	2.3	0.8
Other shrubs	0.1	0.1	1.0 <sup>a</sup>	0.4	0.0	0.0

<sup>a</sup> Means followed by a letter are different ( $P < 0.05$ ).



During the summer, four cover types: LBS, MBS, WBS, and the 1999 prescribed burn, were randomly sampled. Shrub canopy differences were primarily caused by the different sagebrush species, their typical height class characteristics and inclusion of the burn. None of the samples taken from the burn included live sagebrush and there was very little residual dead sagebrush. MBS plots had more other shrubs, rabbitbrush and short grass than the other cover types. MBS and Burn plots had more non-key forb coverage than LSB or WBS sites (Table 12, Appendix I). Shrub cover was 26.7% (SE =2.2) in LSB, 32.2% (SE =3.4) in MBS, and 32.5% (SE =3.4) in WBS.

Shrub canopy cover of WBS plots during the spring averaged 26.9 % (range 16.6-44.3%) and summer 32.5% (range 17.2-49.0%), which revealed that much of the available WBS habitat is less than optimal reproductive habitat for sage grouse. Shrub canopy usually ranges between 5-25% with areas approaching or exceeding 20% in poor ecological condition, usually characterized by overgrazing and depleted herbaceous understory (Miller and Eddleman 2000).

Table 12. Summer random plots mean and standard error, Beatys Butte Allotment, Harney County, Oregon 2000.

Categories	LSB		MBS		WBS		1999 BURN	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Key forbs	4.3	0.8	3.6	1.1	1.5	0.9	4.4	0.7
Non-key Forbs	3.0	0.7	9.7 <sup>a</sup>	1.4	1.7	0.5	9.6 <sup>a</sup>	1.2
Short graminoids	14.0	0.6	27.3 <sup>a</sup>	4.9	15.2	1.7	8.8	1.3
Tall graminoids	1.4	1.0	2.7	1.0	0.0	0.0	2.2	1.3
<b>Shrubs</b>								
Low sagebrush	23.9 <sup>a</sup>	2.5	6.0 <sup>b</sup>	0.9	8.7 <sup>b</sup>	1.8	0.2	0.1
Medium sagebrush	0.2	0.2	13.0 <sup>a</sup>	1.4	14.9 <sup>a</sup>	1.8	0.0	0.0
Tall sagebrush	0.0 <sup>b</sup>	0.0	4.1 <sup>a</sup>	2.0	1.1	0.8	0.0 <sup>b</sup>	0.0
Snowberry	0.0	0.0	0.8	0.7	0.0	0.0	0.0	0.0
Rabbitbrush	2.6	0.8	7.4 <sup>a</sup>	2.1	1.5	0.7	2.3	0.7
Other shrubs	0.0	0.0	1.1 <sup>a</sup>	0.6	0.0	0.0	0.0	0.0

<sup>a</sup> Means followed by a letter are different ( $P < 0.05$ ), means with the same letter are not different.



## HARVEST

Radio-tagged grouse from Beatys Butte Allotment experienced a mortality rate of approximately 34% (10/29) between March and July, 55% (6/11) for males, and 24% (4/17) for females. One female was found dead during hunting season, which raised the non-harvest mortality rate to 29%. In 2000, Oregon had a 5-day season (9-13 September) and Sheldon National Wildlife Refuge in Nevada had a 4-day season (2 weekends 16-17 and 23-24 September). In Oregon, the limit was 2-birds/season and in Nevada the limit was a 3-bird bag limit with 6 birds in possession. Six sage grouse were taken, 2 in the southeastern corner of the allotment and 4 on Sheldon National Wildlife Refuge, further indicating the importance of these areas as summering habitat (Table 13). The birds harvested on Sheldon NWR were captured at Juniper, Last Chance, and Paradise Leks.

Of the radio-tagged birds alive on 1 August, 2 of 5 (40%) males and 0 of 12 (0%) females were harvested. Additionally, 3 of a maximum 25 (12%) banded males and 1 of 6 (17%) banded females were harvested. A minimum of 12% (6/49) of the absolute maximum number of marked sage grouse potentially alive at the beginning of hunting season were harvested. The actual figure is probably higher since it is unlikely that all of the birds banded (but not radio-tagged) survived from banding during the reproductive season until the hunting season. The total mortality rate of radio-tagged males including harvest was 82% (9/11). Other studies also indicated that females have a lower mortality rate than males, with mortality rates ranging from 25-45% for females and 40-62% for males (Schroeder *et al* 1999).



Table 13. Summary of sage grouse banded on Beatys Butte Allotment and harvested in southeastern Oregon and northeastern Nevada, 2000.

Band	Sex	Age	Location	Date	Radio
2300	Male	Y	W of Snake Eyes Spring	10 Sept.	No
2502	Female	A	Sheldon- Catnip Reservoir	24 Sept	No
2307	Male	Y	Sheldon	24 Sept.	Yes <sup>a</sup>
2318	Male	A	Near Antelope Butte	10 Sept.	No
2525	Male	A	Sheldon	24 Sept.	Yes
2527	Male	U	Sheldon	24 Sept.	No

<sup>a</sup> Lost radio 21 May.

## MANAGEMENT IMPLICATIONS

The results of this study indicated that the nests of radio-tagged female sage grouse on Beatys Butte Allotment had less residual tall (> 20cm) grass cover than successful or unsuccessful nests at other study areas (Coggins 1997, Gregg *et al* 1994, Sveum *et al* 1998). The limited amount of residual tall grass cover and resulted in increased nest predation (Gregg 1992, DeLong 1995). Management practices that increase residual tall grass cover such as modification of livestock grazing regimens or other intensive management practices to reverse sagebrush dominance and increase the herbaceous components are needed to increase nest success and, ultimately, reproductive output from sage grouse on this area.

The brooded female behaved as observed at other study areas. She took her brood to LSB habitats during early brood rearing and MBS habitats during the late brood rearing period. These areas were moister than generally available and though there were not greater amounts of forbs available in these areas, forbs were available longer there. Typically there are more forbs at brood locations (Drut *et al* 1994). High quality brood rearing habitat should be maintained by not altering the juxtaposition of different cover types through their removal. Management practices that increase the availability of key forbs could improve the quality of brood-rearing areas.



Sage grouse on Beatys Butte allotment appear migratory from lek and nesting areas to summering grounds. Males moved to 3 areas: Sheldon National Wildlife Refuge, southeastern corner of the allotment by Snake Eyes Spring, and to higher elevations in North Pasture. Females moved to the same general areas as the males and to Hawksy Walksy and higher elevations near Acty Mountain. The summer movement to higher elevation maybe temporary with birds remaining in these mesic areas until the herbaceous vegetation became desiccated (Wallestad 1971); a female relocated in North Pasture during July and August was on Sheldon NWR in September (M.A. Gregg pers. commun.). All radio-tagged sage grouse used big sagebrush habitats after the display or nesting seasons. Sage grouse have traditional use areas and individuals display fidelity to these sites (Schroeder *et al* 1999). These areas should continue to be mapped and taken into consideration when developing or otherwise altering an area. Beatys Butte sage grouse regularly moved across state and administrative boundaries. It is necessary to coordinate management activities to avoid adversely affecting seasonal core areas. Proper management of sage grouse on the Beatys Butte allotment must take into account the adjacent sites, particularly Sheldon National Wildlife Refuge and likely Hart Mountain National Antelope Refuge, are part of the year-round habitat used by this sub-population. Any management plan should include these 3 areas (at a minimum) and must provide for consistent management across all areas.



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## APPENDICES

Appendix A. UTM coordinates of sage grouse study leks on the Beatys Butte Allotment, Harney County, Oregon, 2000.

Lek	UTME	UTMN
Aspen	306.858	4678.617
Corral	321.580	4665.541
Juniper	307.712	4668.831
Last Chance	318.218	4663.403
Paradise Complex		
Paradise #1	307.725	4676.863
Paradise #2	307.511	4677.417
Paradise #3	307.400	4676.000
Paradise Hill	308.065	4677.633
Potholes	303.124	4667.607
Snip	318.554	4665.588

Appendix B. Sage Hen Flats aerial lek survey 28 March-6 April 2000 by Oregon Department of Fish and Wildlife, Beatys Butte Allotment, Lake and Harney Counties, Oregon.

ODFW Lek	Latitude	Longitude	UTME	UTMN	Study Lek
Sagehen #1	42 07.49	119 10.10	320.851	4665.708	
Sagehen #2	42 07.17	119 09.10	322.214	4665.080	Corral
Sagehen #3	42 06.43	119 12.10	318.045	4663.816	Last Chance
Sagehen #4	42 13.31	119 20.11	307.335	4676.841	Paradise #2
Sagehen #5	42 13.46	119 20.06	307.432	4677.118	Paradise #1
Sagehen #6	42 17.09	119 21.38	305.802	4683.886	
Sagehen #7	42 07.77	119 11.51	318.922	4662.275	Snip
Sagehen #8	42 04.31	119 27.45	296.295	4661.068	
Sagehen #9	42 09.10	119 14.16	315.336	4668.883	
Sagehen #10	42 09.10	119 19.73	307.665	4669.036	Juniper



Appendix C. Male sage grouse banded on Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

BAND#	DATE	SEX	AGE	LOCATION	UTME	UTMN	COMMENTS
2300	4/10	M	Y	JUNIPER	307.712	4668.831	Recap. 4/12 w/dislocated tarsus
2301	4/10	M	A	JUNIPER	307.712	4668.831	150.683 <sup>a</sup>
2302	4/12	M	Y	LAST CHANCE	318.218	4663.403	150.284(4/26)
2303	4/12	M	A	CORRAL	321.580	466.541	
2304	4/13	M	A	LAST CHANCE	318.218	4663.403	
2305	4/15	M	A	PARADISE	307.725	4677.418	
2306	4/25	M	A	LAST CHANCE	318.218	4663.403	150.683
2307	4/25	M	Y	LAST CHANCE	318.218	4663.403	150.192
2308	4/26	M	A	ASPEN	306.858	4678.617	
2309	4/27	M	A	ASPEN	306.858	4678.617	
2316	4/15	M	Y	PARADISE	307.725	4677.418	150.522
2317	4/15	M	A	PARADISE	307.725	4677.418	
2318	4/15	M	A	PARADISE	307.725	4677.418	
2319	4/15	M	Y	PARADISE	307.725	4677.418	150.513
2320	4/17	M	Y	ASPEN	306.858	4678.617	150.673
2503	3/28	M	U	PARADISE	307.725	4677.418	150.571
2504	3/28	M	U	PARADISE	307.725	4677.418	
2505	4/5	M	Y	PARADISE	307.725	4677.418	
2506	4/9	M	A	PARADISE	307.725	4677.418	
2507	4/7	M	A	POTHOLES	303.124	4667.607	
2508	3/29	M	U	ASPEN	306.858	4678.617	150.593
2509	3/29	M	U	ASPEN	306.858	4678.617	150.564
2510	3/22	M	U	POTHOLES	303.124	4667.607	
2513	3/30	M	U	POTHOLES	303.124	4667.607	
2514	3/30	M	U	POTHOLES	303.124	4667.607	
2515	3/30	M	U	POTHOLES	303.124	4667.607	
2517	3/30	M	U	POTHOLES	303.124	4667.607	
2518	3/30	M	U	POTHOLES	303.124	4667.607	
2519	3/30	M	U	POTHOLES	303.124	4667.607	
2520	4/7	M	A	POTHOLES	303.124	4667.607	
2521	3/25	M	U	PARADISE	307.725	4677.418	
2524	3/28	M	U	PARADISE	307.725	4677.418	
2525	4/25	M	A	LAST CHANCE	318.218	4663.403	150.642
2526	3/29	M	U	PARADISE	307.725	4677.418	
2527	3/29	M	U	PARADISE	307.725	4677.418	
2528	3/28	M	U	PARADISE	307.725	4677.418	150.663
2529	3/22	M	U	ASPEN	306.858	4678.617	

<sup>a</sup> Radio-transmitter frequency

Appendix D. Female sage grouse banded on Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

BAND#	DATE	SEX	AGE	LOCATION	UTME	UTMN	COMMENTS
1701	3/31	F	Y	PARADISE	307.725	4677.418	150.464 <sup>a</sup>
1702	4/15	F	Y	PARADISE	307.725	4677.418	151.104
1703	4/5	F	Y	POTHOLES	303.124	4667.607	150.762
1704	4/5	F	Y	POTHOLES	303.124	4667.607	151.284
1705	3/29	F	A	JUNIPER	307.712	4668.831	150.583
1706	4/17	F	Y	SNIP	318.554	4665.588	150.313
1707	4/24	F	A	SNIP	318.554	4665.588	151.065
1708	4/12	F	Y	SNIP	318.554	4665.588	151.263
1709	4/11	F	Y	ASPEN	306.858	4678.617	151.252
1710	4/6	F	A	ASPEN	306.858	4678.617	150.324
1711	4/6	F	Y	ASPEN	306.858	4678.617	150.203
1712	4/10	F	A	LAST CHANCE	318.218	4663.403	151.274
1718	4/12	F	Y	JUNIPER	307.712	4668.831	150.184
1724	4/6	F	Y	PARADISE	307.725	4677.418	150.264
1728	4/5	F	Y	PARADISE	307.725	4677.418	150.113
2321	4/21	F	U	SNIP	318.554	4665.588	150.673
2501	3/20	F	U	HAWKS VALLEY	NA	NA	
2502	3/20	F	A	HAWKS VALLEY	NA	NA	
2512	3/30	F	U	POTHOLES	303.124	4667.607	
2522	3/25	F	U	PARADISE	307.725	4677.418	
2523	3/25	F	U	PARADISE	307.725	4677.418	
2530	3/22	F	U	ASPEN	306.858	4678.617	
NA	3/28	F	A	PARADISE	307.725	4677.418	151.083

<sup>a</sup> Radio-transmitter frequency



Appendix E. Relocations of radio-tagged male sage grouse, Beatys Butte Allotment, Harney and Lake County, Oregon, March-July 2000.

Band #	Frequency	DATE	Observation	Cover type	UTME	UTMN
2301	150.683	4/10/00	CAPTURE	LSB	307.712	4668.831
		4/18/00	DEAD	LSB	306.458	4668.881
2302	Banded	4/12/00	CAPTURE	LSB	318.218	4663.403
2302	150.284	4/26/00	CAPTURE	LSB	318.218	4663.403
		5/25/00	Post Lek	LSB	301.590	4667.430
		6/2/00	Post Lek	MSB	301.250	4661.016
		6/8/00	Post Lek	LSB	302.225	4660.238
		6/19/00	Post Lek	LSB	298.680	4654.611
		6/27/00	Post Lek	WBS	299.873	4658.319
		7/8/00	Post Lek	WBS	300.414	4658.129
		7/19/00	Post Lek	WBS	299.966	4658.403
2306	150.683	4/25/00	CAPTURE	LSB	318.218	4663.403
		5/3/00	Lek	LSB	317.770	4663.670
		5/7/00	Lek	LSB	318.123	4663.842
		5/15/00	Lek	LSB	318.093	4663.436
		5/19/00	DEAD	LSB	318.049	4663.757
2307	150.192	4/24/00	CAPTURE	LSB	318.218	4663.403
		5/7/00	Lek	LSB	316.036	4665.101
		5/14/00	Lek	MSC	317.113	4667.724
		5/21/00	LOST RADIO	LSB	315.717	4667.610
		9/24/00	SHOT			
2316	150.522	4/15/00	CAPTURE	LSB	307.511	4677.418
		5/6/00	DEAD	GRA	306.980	4677.650
2319	150.513	4/15/00	CAPTURE	LSB	307.511	4677.418
		5/6/00	Lek	LSB	308.140	4677.170
		5/22/00	Lek	LSB	308.053	4677.585
		6/1/00	Post-Lek	BURN	307.735	4685.332
		6/10/00	DEAD	BURN	306.191	4683.429
2320	150.673	4/17/00	CAPTURE	LSB	306.858	4678.617
		4/19/00	LOST RADIO	LSB	307.017	4678.428
2503	150.571	3/28/00	CAPTURE	LSB	307.511	4677.418
		4/4/00	Lek	LSB	308.410	4678.130
		4/14/00	Lek	LSB	307.948	4677.741
		5/6/00	Lek	LSB	308.140	4677.170
		5/23/00	Post-Lek	LSB	305.610	4683.450
		6/1/00	Post-Lek	BURN	307.735	4685.332
		6/9/00	DEAD	MBS	307.603	4685.363



## Appendix E. (continued)

Band #	Frequency	DATE	Observation	Cover type	UTME	UTMN
2508	150.593	3/29/00	CAPTURE	LSB	307.511	4677.418
		4/8/00	Lek	LSB	306.450	4679.020
		4/14/00	Lek	LSB	306.430	4679.140
		5/6/00	Lek	LSB	307.110	4678.450
		5/18/00	Lek	LSB	307.000	4677.520
		6/2/00	Post Lek	MBS	301.250	4661.016
		6/8/00	Post Lek	LSB	302.700	4660.530
		6/19/00	Post Lek	LSB	302.488	4661.771
		6/27/00	Post Lek	LSB	299.925	4660.181
		7/8/00	Post Lek	WBS	301.211	4661.547
		7/15/00	Post Lek	MBS	301.175	4661.607
		7/19/00		WBS	300.958	4661.693
2509	150.564	3/29/00	CAPTURE	LSB	306.858	4678.617
		4/2/00	Lek	LSB	306.620	4681.130
		4/14/00	Lek	LSB	307.497	4678.423
		5/6/00	Lek	LSB	308.140	4677.170
		5/18/00	Lek	LSB	307.870	4677.380
		6/2/00	Post Lek	LSB	307.788	4675.199
		6/12/00	Post Lek	LSB	307.506	4675.233
		6/22/00	Post Lek	MBS	307.130	4678.247
		7/3/00	Post Lek	BURN	308.206	4686.204
		7/10/00	Post Lek	MBS	307.261	4685.703
		7/16/00	Post Lek	BURN	307.735	4687.172
		7/22/00	Post Lek	BURN	306.620	4687.575
2525	150.642	4/25/00	CAPTURE	LSB	318.218	4663.403
		5/4/00	Lek	LSB	316.120	4664.500
		5/7/00	Lek	LSB	316.036	4665.101
		6/21/00	Post Lek	MBS	303.225	4644.748
		7/20/00	Post Lek	NA	307.487	4644.742
		9/24/00	SHOT			
2528	150.663	3/28/00	CAPTURE	LSB	307.511	4677.418
		4/4/00	Lek	LSB	307.560	4677.590
		4/14/00	Lek	LSB	307.497	4678.423
		5/6/00	Lek	LSB	308.210	4677.300
		5/18/00	Lek	LSB	307.000	4677.520
		5/22/00	Lek	LSB	306.870	4677.390
		6/1/00	DEAD	MBS	307.520	4685.206



Appendix F. Relocations of female sage grouse, Beatys Butte Allotment, Harney and Lake Counties, Oregon, March-July 2000.

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1701	150.464	3/31/00	CAPTURE	LSB		307.511	4677.418
		4/4/00	PRENEST	LSB		308.400	4678.140
		4/6/00	PRENEST	MSC		308.670	4679.290
		4/12/00	PRENEST	LSB		309.110	4685.310
		4/27/00	PRENEST	BURN		309.520	4685.170
		5/1/00	NEST	LSB		309.885	4685.074
		5/7/00	NEST	LSB		309.885	4685.074
		5/13/00	NEST	LSB		309.885	4685.074
		5/19/00	NEST	LSB		309.885	4685.074
		5/23/00	NEST	LSB		309.885	4685.074
		5/25/00	BROODLESS	NA		309.503	4686.304
		5/27/00	BROODLESS	MBS		309.652	4685.243
		5/29/00	BROODLESS	LSB		308.734	4685.226
		6/5/00	BROODLESS	LSB		308.864	4684.883
		6/9/00	BROODLESS	LSB		308.572	4685.384
		6/17/00	BROODLESS	LSB		309.062	4684.705
		6/22/00	BROODLESS	LSB		308.157	4686.034
		6/28/00	BROODLESS	BURN		308.312	4685.389
		7/3/00	BROODLESS	MBS		308.718	4685.493
		7/10/00	BROODLESS	LSB		309.583	4684.982
		7/16/00	BROODLESS	MBS		310.196	4684.721
		7/22/00	BROODLESS	MBS		310.002	4684.807
1702	151.104	4/15/00	CAPTURE	LSB		307.511	4677.418
		4/26/00	NEST	LSB		308.398	4677.863
		4/28/00	NEST	LSB		308.398	4677.863
		5/5/00	NEST	LSB		308.398	4677.863
		5/11/00	NEST	LSB		308.398	4677.863
		5/17/00	NEST	LSB		308.398	4677.863
		5/20/00	HATCHDAY	LSB	EARLY	308.405	4677.950
		5/21/00	BROOD	LSB	EARLY	308.144	4678.185
		5/22/00	BROOD	LSB	EARLY	307.986	4678.433
		5/23/00	BROOD	LSB	EARLY	308.280	4678.056
		5/24/00	BROOD	LSB	EARLY	308.420	4677.925
		5/25/00	BROOD	LSB	EARLY	308.411	4678.230
		5/26/00	BROOD	LSB	EARLY	308.476	4678.063
		5/27/00	BROOD	LSB	EARLY	308.251	4678.087
		5/28/00	BROOD	LSB	EARLY	308.056	4678.467
		5/29/00	BROOD	LSB	EARLY	308.483	4678.043
		5/30/00	BROOD	LSB	EARLY	308.419	4677.853
		5/31/00	BROOD	LSB	EARLY	308.007	4678.467
		6/1/00	BROOD	LSB	EARLY	307.308	4678.479
		6/2/00	BROOD	LSB	EARLY	307.284	4679.104
		6/3/00	BROOD	LSB	EARLY	307.208	4679.091
		6/4/00	BROOD	LSB	EARLY	307.701	4678.683



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1702	151.104	6/5/00	BROOD	LSB	EARLY	307.917	4678.003
		6/6/00	BROOD	LSB	EARLY	307.411	4678.939
		6/7/00	BROOD	MBS	EARLY	308.368	4678.776
		6/8/00	BROOD	LSB	EARLY	308.126	4677.787
		6/9/00	BROOD	LSB	EARLY	308.284	4678.930
		6/10/00	BROOD	LSB	EARLY	308.058	4678.690
		6/11/00	BROOD	LSB	EARLY	308.585	4678.407
		6/12/00	BROOD	LSB	EARLY	308.252	4678.984
		6/13/00	BROOD	LSB	EARLY	307.998	4678.722
		6/15/00	BROOD	MBS	EARLY	308.411	4678.739
		6/16/00	BROOD	MBS	EARLY	308.770	4678.716
		6/17/00	BROOD	LSB	EARLY	308.194	4679.089
		6/18/00	BROOD	MBS	EARLY	307.627	4679.220
		6/19/00	BROOD	LSB	EARLY	308.076	4679.075
		6/20/00	BROOD	MBS	EARLY	307.953	4678.920
		6/22/00	BROOD	MBS	EARLY	307.093	4678.149
		6/24/00	BROOD	MBS	EARLY	308.114	4679.443
		6/26/00	BROOD	MBS	EARLY	307.493	4679.397
		6/28/00	BROOD	MBS	EARLY	307.660	4679.317
		6/30/00	BROOD	MBS	EARLY	307.772	4678.925
		7/2/00	BROOD	MBS	LATE	307.702	4679.003
		7/4/00	BROOD	LSB	LATE	308.024	4678.440
		7/6/00	BROOD	MBS	LATE	307.794	4678.452
		7/8/00	BROOD	MBS	LATE	308.298	4678.642
		7/10/00	BROOD	MBS	LATE	307.422	4679.193
		7/12/00	BROOD	MBS	LATE	307.564	4678.466
		7/15/00	BROOD	MBS	LATE	307.588	4679.211
		7/18/00	BROOD	MBS	LATE	308.264	4678.671
		7/22/00	BROOD	MBS	LATE	307.578	4679.215
		7/25/00	BROOD	MBS	LATE	307.582	4679.271
1703	150.762	4/5/00	CAPTURE	LSB		303.124	4667.607
		4/25/00	NON-NESTING	MSC		312.341	4666.450
		4/28/00	NON-NESTING	MSC		311.705	4666.124
		5/4/00	NON-NESTING	LSB		312.253	4666.485
		5/9/00	NON-NESTING	BBS		312.770	4664.830
		5/15/00	NON-NESTING	LSB		312.509	4666.373
		5/21/00	NON-NESTING	LSB		311.850	4666.450
		5/25/00	NON-NESTING	LSB		310.170	4665.060
		5/30/00	NON-NESTING	MBS		311.410	4667.260
		6/3/00	NON-NESTING	MBS		310.334	4668.619
		6/8/00	NON-NESTING	MBS		309.294	4667.928
		6/13/00	NON-NESTING	MBS		309.720	4668.513
1704	151.284	4/5/00	CAPTURE	LSB		303.124	4667.607
		4/8/00	PRENEST	LSB		304.086	4667.001
		6/9/00	DEAD	LSB		295.726	4653.507



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1705	150.583	3/29/00	CAPTURE	LSB		307.712	4668.831
		4/1/00	RECAPTURE	LSB		NA	NA
		4/2/00	PRENEST	LSB		308.020	4668.380
1705	150.583	4/8/00	PRENEST	LSB		308.140	4668.290
		4/25/00	NON-NESTING	BBS		309.440	4668.638
		4/28/00	NON-NESTING	LSB		309.661	4668.497
		5/4/00	NON-NESTING	LSB		309.917	4668.444
		5/9/00	NON-NESTING	MSC		309.260	4668.770
		5/17/00	NON-NESTING	LSB		306.670	4683.298
		5/22/00	NON-NESTING	LSB		306.170	4683.689
		5/26/00	NON-NESTING	LSB		306.719	4683.786
		6/1/00	NON-NESTING	WBS		310.840	4687.062
		6/7/00	NON-NESTING	LSB		305.725	4687.246
		6/10/00	NON-NESTING	LSB		306.262	4683.689
		6/17/00	NON-NESTING	LSB		306.383	4683.783
		6/22/00	NON-NESTING	LSB		304.520	4687.062
		6/28/00	NON-NESTING	MBS		305.082	4687.246
		7/3/00	NON-NESTING	MBS		304.762	4687.133
		7/10/00	NON-NESTING	MBS		305.113	4685.677
		7/17/00	NON-NESTING	LSB		305.387	4688.456
		7/22/00	NON-NESTING	LSB		306.258	4688.511
1706	150.313	4/17/00	-CAPTURE	LSB		318.554	4665.588
		4/26/00	NEST	LSB		318.286	4665.799
		4/28/00	NEST	LSB		318.286	4665.799
		5/2/00	BROODLESS	LSB		318.510	4664.190
		5/7/00	BROODLESS	LSB		320.787	4665.101
		5/14/00	RENEST	MBS		320.638	4665.445
		5/16/00	RENEST	MBS		320.638	4665.445
		5/23/00	BROODLESS	MBS		317.250	4666.200
		5/29/00	BROODLESS	LSB		315.710	4666.320
		6/1/00	BROODLESS	MBS		317.773	4666.076
		6/7/00	BROODLESS	MBS		320.718	4665.234
		6/12/00	BROODLESS	LSB		320.535	4664.979
		6/17/00	BROODLESS	LSB		321.186	4664.254
		6/18/00	DEAD	MBS		321.175	4664.206
1707	151.065	4/24/00	CAPTURE	LSB		318.554	4665.588
		5/1/00	PRENEST	LSB		317.450	4665.930
		5/2/00	PRENEST	LSB		318.520	4665.190
		5/7/00	PRENEST	LSB		318.530	4665.092
		5/14/00	NEST	LSB		318.433	4665.230
		5/23/00	BROODLESS	MBS		321.900	4663.675
		5/29/00	BROODLESS	MBS		322.150	4663.480
		6/1/00	BROODLESS	MBS		321.602	4664.239
		6/7/00	BROODLESS	MBS		320.718	4665.234
		6/12/00	BROODLESS	LSB		320.832	4664.158
		6/17/00	BROODLESS	MBS		321.290	4664.413



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1707	151.065	6/22/00	BROODLESS	MSB		322.537	4663.187
		7/8/00	BROODLESS	MBS		305.442	4654.687
		7/15/00	BROODLESS	MSC		305.720	4654.349
		7/20/00	BROODLESS	MSC		305.807	4654.621
1708	151.263	4/12/00	CAPTURE	LSB		318.554	4665.588
		4/26/00	NEST	MBS		317.633	4666.030
		4/28/00	NEST	MBS		317.633	4666.030
		5/1/00	BROODLESS	LSB		317.870	4666.380
		5/2/00	BROODLESS	MBS		320.690	4665.030
		5/7/00	BROODLESS	LSB		317.728	4664.183
		5/14/00	BROODLESS	NA		320.840	4665.320
		5/16/00	BROODLESS	MBS		321.520	4665.568
		5/23/00	RENEST	MBS		321.520	4665.568
		5/26/00	RENEST	MBS		321.520	4665.568
		5/29/00	RENEST	MBS		321.520	4665.568
		6/1/00	RENEST	MBS		321.520	4665.568
		6/7/00	BROODLESS	MBS		320.711	4665.266
		6/12/00	BROODLESS	LSB		320.938	4665.813
		6/17/00	BROODLESS	MBS		321.497	4665.636
		6/29/00	BROODLESS	LSB		311.271	4663.022
		7/8/00	BROODLESS	WBS		301.193	4661.127
		7/15/00	BROODLESS	MSC		301.175	4661.607
		7/19/00	BROODLESS	WBS		301.487	4660.822
1709	151.252	4/15/00	CAPTURE	LSB		307.127	4678.792
		4/26/00	PRENEST	LSB		306.690	4683.440
		4/28/00	PRENEST	LSB		306.505	4683.529
		5/1/00	PRENEST	LSB		306.644	4683.704
		5/7/00	UNKNOWN	MBS		306.800	4683.190
		5/13/00	NEST	MBS		306.570	4683.599
		5/17/00	NEST	MBS		306.523	4683.776
		5/22/00	NEST	MBS		306.523	4683.776
		5/26/00	NEST	MBS		306.523	4683.776
		6/1/00	NEST	MBS		306.523	4683.776
		6/7/00	BROODLESS	MBS		305.925	4684.664
		6/10/00	BROODLESS	LSB		306.262	4683.689
		6/17/00	BROODLESS	LSB		306.383	4683.786
		6/22/00	BROODLESS	LSB		304.520	4687.062
		6/28/00	BROODLESS	MBS		305.082	4687.264
		7/3/00	BROODLESS	MBS		304.762	4687.133
		7/10/00	BROODLESS	MBS		305.113	4685.677
		7/17/00	BROODLESS	LSB		305.387	4688.456
		7/22/00	BROODLESS	MBS		307.557	4685.466



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1710	150.324	4/6/00	CAPTURE	LSB		307.243	4678.386
		4/14/00	PRENEST	LSB		307.190	4679.020
		4/28/00	PRENEST	LSB		307.320	4678.380
		5/6/00	UNKNOWN	LSB		307.210	4678.230
		5/11/00	UNKNOWN	LSB		307.120	4678.240
		5/18/00	NON-NESTING	LSB		307.000	4677.520
		5/25/00	NON-NESTING	MBS		310.210	4668.710
		5/30/00	NON-NESTING	MBS		310.260	4668.420
1710	150.324	6/3/00	NON-NESTING	MBS		310.334	4668.619
		6/8/00	NON-NESTING	MBS		309.294	4667.928
		6/13/00	NON-NESTING	MBS		309.720	4668.513
		6/16/00	NON-NESTING	MBS		309.653	4668.169
		6/21/00	NON-NESTING	MBS		300.683	4656.702
		6/27/00	NON-NESTING	MBS		297.122	4657.465
		7/8/00	NON-NESTING	MSC		295.816	4649.198
1711	150.203	4/6/00	CAPTURE	LSB		306.490	4679.400
		4/8/00	PRENEST	LSB		306.020	4680.000
		4/17/00	PRENEST	LSB		306.880	4681.680
		4/25/00	NEST	LSB		306.560	4680.574
		4/28/00	NEST	LSB		306.560	4680.574
		5/2/00	DEAD	LSB		307.770	4680.320
1712	151.274	4/10/00	CAPTURE	LSB		318.218	4663.403
		4/19/00	NEST	LSB		316.611	4664.662
		4/24/00	NEST	LSB		316.581	4664.642
		4/30/00	NEST	LSB		316.581	4664.642
		5/2/00	NEST	LSB		316.581	4664.642
		5/7/00	BROODLESS	MBS		321.460	4664.390
		5/12/00	BROODLESS	MBS		321.710	4664.800
		5/16/00	BROODLESS	MBS		321.663	4664.672
		5/23/00	BROODLESS	MBS		321.675	4664.125
		5/29/00	BROODLESS	MBS		320.370	4660.100
		6/1/00	BROODLESS	MBS		321.130	4665.365
		6/7/00	BROODLESS	MBS		320.718	4665.234
		6/12/00	BROODLESS	LSB		317.491	4664.005
		6/17/00	BROODLESS	MBS		321.639	4664.569
		6/22/00	BROODLESS	MBS		322.537	4663.187
		7/9/00	BROODLESS	MSC		323.092	4661.640
		7/16/00	BROODLESS	MSC		322.806	4662.374
		7/22/00	BROODLESS	MSC		323.474	4661.996
1718	150.184	4/12/00	CAPTURE	LSB		306.858	4669.748
		4/18/00	PRENEST	LSB		307.920	4670.000
		4/25/00	NEST	LSB		307.059	4669.773
		4/28/00	NEST	LSB		307.059	4669.773
		5/1/00	NEST	LSB		307.059	4669.773



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1718	150.184	5/4/00	NEST	LSB		307.059	4669.773
		5/9/00	NEST	LSB		307.059	4669.773
		5/15/00	BROODLESS	NA		304.000	4670.000
		5/19/00	BROODLESS	MBS		304.080	4670.690
		5/25/00	BROODLESS	MBS		304.290	4670.530
		6/2/00	BROODLESS	MBS		304.000	4670.881
		6/19/00	BROODLESS	MBS		297.739	4659.101
		6/27/00	BROODLESS	WBS		296.827	4654.483
		7/18/00	BROODLESS	MBS		296.792	4629.419
1724	150.264	4/6/00	CAPTURE	LSB		307.511	4677.418
		4/14/00	PRENEST	LBS		308.410	4678.480
		4/26/00	PRENEST	LSB		308.380	4678.310
		5/5/00	NEST	MBS		308.283	4678.335
		5/11/00	NEST	MBS		308.283	4678.335
		5/17/00	NEST	MBS		308.283	4678.335
		5/20/00	ABANDON.				
		5/23/00	BROODLESS	WBS		308.150	4681.600
		5/26/00	BROODLESS	LSB		309.802	4679.719
		5/29/00	BROODLESS	MBS		308.355	4678.531
		6/1/00	BROODLESS	LSB		308.195	4678.490
		6/4/00	BROODLESS	MBS		308.096	4678.673
		6/7/00	BROODLESS	LSB		308.368	4678.776
		6/10/00	BROODLESS	MBS		308.155	4678.725
		6/16/00	BROODLESS	LSB		308.289	4678.391
		6/18/00	BROODLESS	MSC		308.579	4679.808
		6/22/00	BROODLESS	MBS		307.434	4684.175
		6/28/00	BROODLESS	BURN		306.192	4684.938
		7/3/00	BROODLESS	MBS		305.211	4687.034
		7/10/00	BROODLESS	MBS		305.113	4685.677
1728	150.113	7/17/00	BROODLESS	LSB		305.387	4688.465
		7/22/00	BROODLESS	LSB		306.258	4688.511
		4/5/00	CAPTURE	LSB		307.400	4676.000
		4/14/00	PRENEST	LSB		307.460	4677.320
		4/19/00	PRENEST	LSB		307.235	4676.620
		4/27/00	PRENEST	LSB		309.490	4684.890
		5/1/00	PRENEST	LSB		308.867	4684.647
		5/7/00	PRENEST	LSB		309.450	4684.830
		5/13/00	PRENEST	LSB		309.030	4684.556
		5/20/00	NEST	LSB		309.058	4684.814
		5/23/00	NEST	LSB		309.058	4684.814
		5/29/00	NEST	LSB		309.058	4684.814
		6/5/00	NEST	LSB		309.058	4684.814
		6/10/00	NEST PRED				
		7/8/00	BROODLESS	MBS		294.491	4660.013
		7/16/00	BROODLESS	BURN		307.788	4688.116



## Appendix F. (continued)

Band #	Frequency	DATE	Observation	Cover type	Brood Per.	UTME	UTMN
1728	150.113	7/22/00	BROODLESS	LSB		306.258	4688.511
2321	150.673	4/21/00	CAPTURE	LSB		318.554	4665.588
		5/2/00	NON-NESTING	LSB		314.050	4661.750
		5/7/00	NON-NESTING	LSB		318.210	4659.230
		5/9/00	NON-NESTING	MBS		319.770	4659.790
		5/12/00	NON-NESTING	MBS		320.220	4659.740
		5/14/00	NON-NESTING	LSB		315.290	4658.417
		5/31/00	NON-NESTING	LSB		316.310	4657.570
		6/5/00	NON-NESTING	WBS		315.925	4657.601
		6/12/00	NON-NESTING	WBS		314.808	4656.816
		6/18/00	NON-NESTING	MBS		316.857	4657.175
2321	150.673	6/22/00	NON-NESTING	WBS		319.874	4658.376
		7/9/00	NON-NESTING	LAK		323.409	4654.905
		7/18/00	NON-NESTING	LAK		324.071	4654.308
NA	151.083	7/22/00	NON_NESTING	LAK		323.314	4654.515
		3/28/00	CAPTURE	LSB		307.511	4677.418
		4/17/00	NEST	MBS		306.052	4685.072
		4/25/00	NEST	MBS		306.170	4685.190
		4/28/00	NEST	MBS		306.052	4685.072
		5/1/00	BROODLESS	MBS		306.348	4685.205
		5/7/00	BROODLESS	MBS		307.080	4684.980
		5/13/00	DEAD	MBS		306.361	4686.768

## Appendix G. Frequency (%) of habitat components at nest and brood plots, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Categories	NEST				BROOD			
	LSB		MBS		LSB		MBS	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Key forbs	78	20-100	67	10-90	60	10-100	73	50-100
Non-key Forbs	94	90-100	95	70-100	88	50-100	94	80-100
Short grass	93	60-100	97	80-100	99	90-100	93	70-100
Tall grass	8	0-30	12	0-70	24	0-80	14	0-50
<b>Shrubs</b>								
Low Sagebrush	75	50-90	63	55-80	59	0-95	17	0-55
Med. Sagebrush	7	0-35	51	45-50	1	0-5	50	10-80
Tall Sagebrush	1	0-5	8	0-25	0	-	5	0-25
Snowberry	0	-	12	0-70	1	0-5	29	0-75
Rabbit brush	3	0-15	26	0-55	4	0-45	22	0-50
Other shrubs	0	-	3	0-30	1	0-15	9	0-65



Appendix H. Frequency (%) of habitat components at spring random plots, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Categories	LSB		MBS		WBS	
	Mean	Range	Mean	Range	Mean	Range
Key forbs	86	30-100	77	40-100	94	90-100
Non-key Forbs	88	60-100	91	40-100	95	80-100
Short graminoids	96	80-100	95	70-100	95	90-100
Tall graminoids	0	-	5	0-40	0	0-40
<b>Shrubs</b>						
Low Sagebrush	76	45-90	33	10-50	29	5-45
Med. Sagebrush	0	-	38	15-60	44	30-70
Tall Sagebrush	0	-	10	0-65	11	0-40
Snowberry	0	-	13	0-85	0	-
Rabbit brush	14	0-50	20	0-55	15	0-45
Other shrubs	1	0-5	8	0-30	0	-

Appendix I. Frequency (%) of habitat components summer random plots, Beatys Butte Allotment, Harney and Lake Counties, Oregon, 2000.

Categories	LSB		MBS		WBS		Burn	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Key forbs	63	40-90	46	0-100	19	0-70	60	0-90
Non-key Forbs	79	50-100	93	70-100	70	40-100	92	70-90
Short graminoids	96	60-100	99	90-100	93	80-100	88	60-100
Tall graminoids	1	0-10	10	0-20	0	-	18	0-80
<b>Shrubs</b>								
Low Sagebrush	79	50-100	26	0-45	39	0-60	4	0-20
Med. Sagebrush	1	0-5	39	15-70	38	10-70	0	-
Tall Sagebrush	0	-	10	0-45	7	0-30	0	-
Snowberry	0	-	3	0-20	0	-	0	-
Rabbit brush	13	0-35	30	10-65	8	0-20	13	0-35
Other shrubs	0	-	6	0-30	0	-	0	-







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